

Title: Let's Make Connections with Patterns!

Brief Overview:

This is a series of seven activities designed to further the understanding of the significance of patterns in mathematics. The unit begins with an introduction to patterns and their integration in real-world situations. Activities include: (a) copying and continuing patterns, (b) creating patterns, (c) identifying pattern rules, (d) writing responses, (e) demonstrating knowledge of function tables, (f) testing problem-solving strategies, and (g) using number sentences. The unit culminates with a real-life application.

Links to Standards:

- **Mathematics as Problem Solving**

Use problem-solving approaches to investigate and understand mathematical content; formulate problems from everyday and mathematical situations; and develop and apply strategies to solve a wide variety of problems.

- **Mathematics as Communication**

Relate physical materials, pictures and diagrams to mathematical ideas; reflect on and clarify their thinking about mathematical ideas and situations; relate their everyday language to mathematical language and symbols; and realize that representing, discussing, reading, writing, and listening to mathematics are a vital part of learning and using mathematics.

- **Mathematics as Reasoning**

Draw logical conclusions about mathematics; use models, known facts, properties, and relationships to explain their thinking; justify their answers and solution processes; and use patterns and relationships to analyze mathematical situations.

- **Mathematical Connections**

Relate various representations of the concept; use mathematics in other curriculum areas; and use mathematics in their daily lives.

- **Patterns and Relationships**

Model expressions using concrete materials; generalize a rule for a pattern; given a function table write the rule; given a functional relationships, describe how a change in one variable results in a change in the other; solve for a missing number in a number sentence.

Grade/Level:

Grades 4-5

Prerequisite Knowledge:

Students should have working knowledge of the following skills.

- copying a modeled pattern
- understanding pattern rules
- computations (addition, subtraction, multiplication)
- knowledge of a function table
- understanding of number sentences

Objectives:

Students will:

- work cooperatively in groups.
- continue different types of patterns.
- create patterns.
- explain pattern rules.
- extend patterns.
- represent a pattern in another way.
- make predictions.
- organize data using a function table.
- analyze functional relationships in patterns.
- state the appropriate number sentence.
- justify results through the writing process.
- apply knowledge to a real-world activity.

Materials/Resources/Printed Materials:**Activity 1:**

- The Quilt Story, by Tony Johnston and Tomie dePaola (Scholastic, 1985)
- quilt, if available

Activity 2:

- geometric-shaped pattern blocks (or a variety of small items, i.e., bread tags, buttons, etc., if commercial items are not available)
- overhead pattern blocks and overhead
- "Math Talk" chart (to display math vocabulary words)

Activity 3:

- pattern blocks
- math journal

Activity 4:

- pattern blocks
- sentence strips
- math journal

Activity 5:

- same as above

Activity 6:

- pattern blocks
- overhead pattern blocks and overhead
- function table transparency

Activity 7:

- Student Resource #1
- Teacher Resource #1
- crayons

Development/Procedures:

Activity 1: Students will discuss their knowledge of quilts and the relationship to patterns.

- Lead a discussion on the students' knowledge of quilts.
- Introduce and read The Quilt Story, by Tony Johnston and Tomie dePaola.
- Discuss story and relate the quilt patterns to mathematics.
- Review the math word, pattern.

Activity 2: Students will copy and continue modeled pattern.

- Distribute pattern blocks and display pattern on overhead.
- Have students copy and continue modeled pattern using the pattern blocks.
- Have students share their observations with a partner and discuss the pattern rule used.
- Identify pattern rule, using the ABC format.

FOR EXAMPLE,

A	B	A	B
red	blue	red	blue
circle	square	circle	square
A	A	B	B
green	green	yellow	yellow
triangle	triangle	rhombi	rhombi

- Introduce the math words: core, sequence and term.

Core - the part of the pattern that shows the repetition.

Sequence - the whole pattern (ABAB ABAB ABAB).

Term - the individual unit of the pattern (A).

Activity 3: Students will represent pattern rule in another way.

- Distribute pattern blocks.
- Ask students to recall pattern rule used in Activity 2.
- Have students represent the pattern rule in another way.

FOR EXAMPLE,

A	B	A	B
orange	purple	orange	purple
A	A	B	B
square	square	circle	circle

- Have students record their observations in their math journal. Encourage them to use the math vocabulary displayed on the "Math Talk" chart. (Teacher will determine Rubric Scale for evaluating responses.)
- Students will share their observations with their class.

Activity 4: Students will create their own pattern and identify their rule.

- Look around classroom and observe the different types of patterns.
- Discuss different types of patterns, for example: shapes, size and color.
- Distribute pattern blocks and a sentence strip to each student.
- Instruct students to create their own pattern on the sentence strip with the blocks.
- Once students have established their pattern they will write in their math journal. The writing will include identifying and illustrating the core, explaining their pattern and justifying why it is a pattern.

Activity 5: Students will extend a partner's pattern and identify the pattern rule.

- Pass out materials and have students reproduce the pattern from their Activity 4 journal entry.
- Switch seats with their neighbor in order to extend the pattern started by their peer. Students should take their math journal with them.
- Students extend the pattern and identify the pattern rule.
- Students should record findings in their math journal and trade the journal with their neighbor.
- Partner checks findings to see if pattern rule is the same.
- Discuss findings. If findings are different, the students will be encouraged to justify their answers.

Activity 6: Students will demonstrate their knowledge of function tables. Students will gain an understanding of the relationship of the terms on a function table.

- Teacher will encourage the students to recall the discussion of quilts from Activity 1. Symbols and shapes on the quilt represent something significant to the quilt owner (i.e., family history). Refer to The Quilt Story to illustrate the use of symbols and shapes.
- Distribute materials.
- Construct a flower pattern, using overhead pattern blocks, with one hexagon and six triangle shapes. (The hexagon is the center of the flower and the triangles represent the petals.)
- Ask the question, "How many petals will two flowers have?"
- Students can manipulate blocks to derive answer.
- Teacher should model on the overhead how to make a function table, as shown.
- Teacher and students should record the data for the first two problems on the function table.

Number of Flowers	Number of Petals
1 *	6
2 * *	12
5 * * * * *	30
20 ?	
50 ?	

(Key: The * represents the one hexagon and six triangles for the purpose of demonstration.)

- Ask, "How many petals will five flowers have?" Record data on function table.
- Teacher monitors students' responses.
- Ask, "Can anyone predict how many petals twenty flowers will have?"
- Ask, "Can anyone create an equation which explains this function?"
- Teacher should be aware of the complexity of transitioning from the concrete to the abstract level.
 - For every flower there are six petals.
 - Number of flowers times number of petals equal total number of petals.
 - $F \times P = x$
 - $20 \times 6 = 120$
 - $50 \times 6 = 300$
- Introduce the math term: relationship and add to "Math Talk" chart.
Relationship - the comparison of the size, shape, or value of two or more terms.
- Have students extend the function table.
- Discuss data and check for understanding.

Activity 7: Students will test strategies to solve a problem and state the problem using a number sentence.

- Show the example of the quilt on the last page of The Quilt Story. Mention that, in addition to symbols and shapes, letters can be sewn on the quilt.
- Pass out Student Resource #1 and one crayon per student.
- Students will be instructed to print one letter of their first name in each block of the 6 x 6 grid and repeat until the chart is filled. (No spaces should be left empty.)
- Color the first letter of name each time it occurs on chart.
- Teacher will select and display one sample of students' names for a three letter name, four letter name, and so forth.
- Compare and contrast the grids (charts).
- Note the names that were diagonal on this size grid.
- Ask, "What size grid would you need for your name to be diagonal?"
- Allow time to investigate problem.
- Have students state answer in number sentence format (letters of name - 1 = size of grid, $n - 1 = x$).
- Say, "We could use our name grids to construct a class quilt. Our names printed diagonally would make an interesting pattern."
- The extension list suggests follow-up activities for the quilt theme and other patterning possibilities.

Performance Assessment:

Students will be evaluated based on the following criteria:

- group participation and performance
- journal writing
- written or oral responses stated in numerical terms
- recognition of patterns
- completed name grid

Extension/Follow Up:

- Design and construct a class quilt using students' names. Include symbols and shapes that have individual significance to each student.
- Students construct their own pattern using stickers on sentence strips (see Activity 4). These patterns can be utilized by teacher as a "Problem of the Day" for the class to identify.
- Add math vocabulary words to the "Math Talk" chart as words are utilized. Additional words include: increase, data, function, and table.

- Students would benefit from viewing examples of math journal entries from other classes to critique and target. This will enable the students to gain an understanding of the Rubric Scale expectations without causing embarrassment to classmates. Writing opportunities in math class allow the teacher to integrate other curriculum areas to mathematics. Teacher could score twice: once for math justification and once for written response. Students may also complete self-evaluation. See suggestions for literature connection included in this unit.
- Continue the study of patterns and relate it to real-life situations, such as architecture, nature, and mathematical concepts: money, graphs, formulas, and models.
- Recognize that patterns are the foundation of mathematics.

Authors:

Judy Davis
Mardela Middle/ High School
Wicomico County, MD

Cheryl Kennedy
Mardela Middle/High School
Wicomico County, MD

RUBRIC FOR ACTIVITY 7

- 4 points:** Grid was completed correctly and corresponding number sentence was stated correctly.
- 3 points:** Grid was completed correctly and an attempt was made to identify number sentence.
- 2 points:** Directions were followed and grid was completed correctly.
- 1 point:** Grid attempted but not completed correctly.
- 0 points:** No attempt is made.

CONNECTIONS WITH LITERATURE

Cobb, Mary. The Quilt-block History of Pioneer Days with Projects Kids Can Make.
CT: Millbrook Press, 1995.

Coerr, Eleanor. The Josefina Story Quilt. NY: Harper Collins, 1986.

Flourney, Valerie. The Patchwork Quilt. NY: Dial, 1985.

Hopkinson, Deborah. Sweet Clara and the Freedom Quilt. NY: Knopf, 1993.

Johnston, Tony. dePaola Tomie. The Quilt Story. NY: Scholastic, Inc., 1985.

Lyons, May. E. Stitching Stars: The Story Quilts of Harriet Powers. NY: Scribners,
1993.

Paul, Ann W. Eight Hands Round: A Patchwork Alphabet. NY: Harper Collins, 1991.

Polacco, Patricia. The Keeping Quilt. NY: Simon & Schuster, 1988.

For the Adult Readers:

Burns, Eleanor & William. Quilt in a Day: Log Cabin Patterns. CA: Quilt in a Day, 1989.

Walsh, Jill Paton. A Piece of Justice. NY: St. Martin's Press, 1995.

Resource Catalogs:

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